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JUN 21 1965
ONTARIO WATER
RESOURCES COMMISSION

ANNUAL REPORT 1964

NEPEAN

water pollution control plant

DIVISION OF PLANT OPERATIONS
Ontario Water Resources Commission

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ONTARIO WATER RESOURCES COMMISSION

OFFICE OF THE GENERAL MANAGER

Members of the Nepean Local Advisory Committee,
Township of Nepean.

Gentlemen:

We are pleased to provide you with the 1964 Operating Report for the Nepean Water Pollution Control Plant, OWRC Project No. 59-S-35.

By continuing the mutual cooperation which has existed in the past, we can look forward to greater progress in the field of water pollution control.

Yours very truly,

D. S. Caverly, P. Eng.
General Manager

General Manager,
Ontario Water Resources Commission.

Dear Sir:

It is with pleasure that I present to you the Annual Report of the operation of the Nepean Water Pollution Control Plant, OWRC Project No. 59-S-35 for 1964.

This report presents design data, outlines operating problems encountered and summarizes in tables, charts and graphs all significant flow and cost data.

Yours very truly,

B C Palmer

B. C. Palmer, P. Eng.,
Director,
Division of Plant Operations.

FOREWORD

This report describes the operation of this project for the year 1964. It includes a detailed description of the project, summary of operation, graphs and charts showing quality and quantity information, and project cost data.

This information will be of value to the municipality in assessing the adequacy of the works in meeting existing requirements and in projecting its capability to meet future expected demands. The cost information will be of particular interest to those concerned with developing and maintaining revenue structures.

The preparation of this report has been a cooperative effort of several groups within the Division of Plant Operations. These include the Statistical Section, Brochures Officer and the Regional Supervisor. However, the primary responsibility for the content has been with the Regional Operations Engineer. He will be pleased to discuss all aspects of this report with the municipality.

B. C. Palmer, P. Eng.,
Director,
Division of Plant Operations.

CONTENTS

Foreword	1
Title Page	3
'64 Review	4
Glossary	5
History	6
Project Staff	7
Description of Project	8
Project Costs	10
Plant Flow Chart	15
Design Data	17
Process Data	18

NEPEAN

water pollution control plant

operated for

THE TOWNSHIP OF NEPEAN

by

THE ONTARIO WATER RESOURCES COMMISSION

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Assistant Director: C. W. Perry
Regional Supervisor: D. A. McTavish
Operations Engineer: J. N. Dick

801 Bay Street **Toronto 5**

'64 REVIEW

It is the purpose of this report to give significant data on the operation of the Township of Nepean Water Pollution Control Plant for 1964.

The average daily flow to the plant in 1964 again frequently exceeded the design flow of 1.5 mgd. The average daily flow in 1964 was approximately 2.0 mgd.

The total operating cost of the treatment plant and the two associated pumping stations in 1964 was $31,159.12. The amount of waste treated in 1964 was 726.4 million gallons. The cost of treatment per million gallons in 1964 was $42.89. In 1963 the cost of treatment per million gallons was $47.08 and in 1962 the cost of treatment per million gallons was approximately $47.18. The main reason for the decrease in the treatment costs per million gallons for 1964 was the increased flow to the plant.

Although the total operating costs for 1962, 1963 and 1964 have been quite consistent, some variations have occurred. The casual payroll in 1964 was approximately $900 less than in 1963. Fuel Costs were about $2135 less in 1964 than in 1963. This can be attributed to the increased gas production of the digester.

The power costs were increased approximately $600 in 1964. This increase was due primarily to the increased flows to the plant. Chlorine costs were considerably higher in 1964 than in 1963, however, the reason for this increase was due to the credit in 1963 of empty chlorine cylinders for 1962 and 1963. Maintenance and repair costs were up about $2000 due to increased wear on various equipment.

Inspections conducted by head office engineers and technicians in 1964 revealed satisfactory operation of the plant and maintenance of equipment. The plant was also in a clean and tidy condition during these inspections.

The strength of the waste in 1964 was increased compared to that in 1963. Combined with the increased flow to the plant it should be recognized that the load to the plant was substantially increased in 1964.

GLOSSARY

BOD	biochemical oxygen demand (a measure of organic content)
cfm	cubic feet per minute
comminution	shredding of solids into small fragments
DWF	dry weather flow
effluent	outflow
flocculation	bringing very small particles together to form a larger mass (the floc) before settling
fps	feet per second
gpcd	gallons per capita per day
gpm	gallons per minute
grit	sand, dust, stones, cinders and other heavy inorganic material
influent	inflow
lin. ft.	lineal feet
mgd	million gallons per day
mlss	mixed liquor suspended solids
ppm	parts per million
ss	suspended solids
TDH	total dynamic head (usually refers to pressure on a pump when it is in operation)

HISTORY
1959 - 1964

INCEPTION

On January 12, 1959, the Council of the Township of Nepean passed a resolution requesting the Ontario Water Resources Commission to undertake the construction of a trunk sewer line and sewage treatment plant. The Township Engineer, J. A. Chalmers, was engaged to prepare plans and specifications for the trunk sewer and the firm of Beaco Limited to prepare plans and specifications for the sewage treatment plant.

APPROVAL

In 1959, the Township of Nepean signed an agreement with the Ontario Water Resources Commission to finance, construct and operate the system.

CONSTRUCTION

Spino Construction Company Limited, Montreal, Quebec and Keystone Contractors Limited, Ottawa, Ontario began the construction of the trunk sewer early in 1960. George A. Crain and Sons Limited, Ottawa, Ontario began the construction of the sewage treatment plant in 1961. Late in the year 1961, the Division of Plant Operations took over the operation of the plant.

TOTAL COST

59-S-35	$ 1,351,191.62
61-S-76	162,540.24



D. FORBES
CHIEF OPERATOR

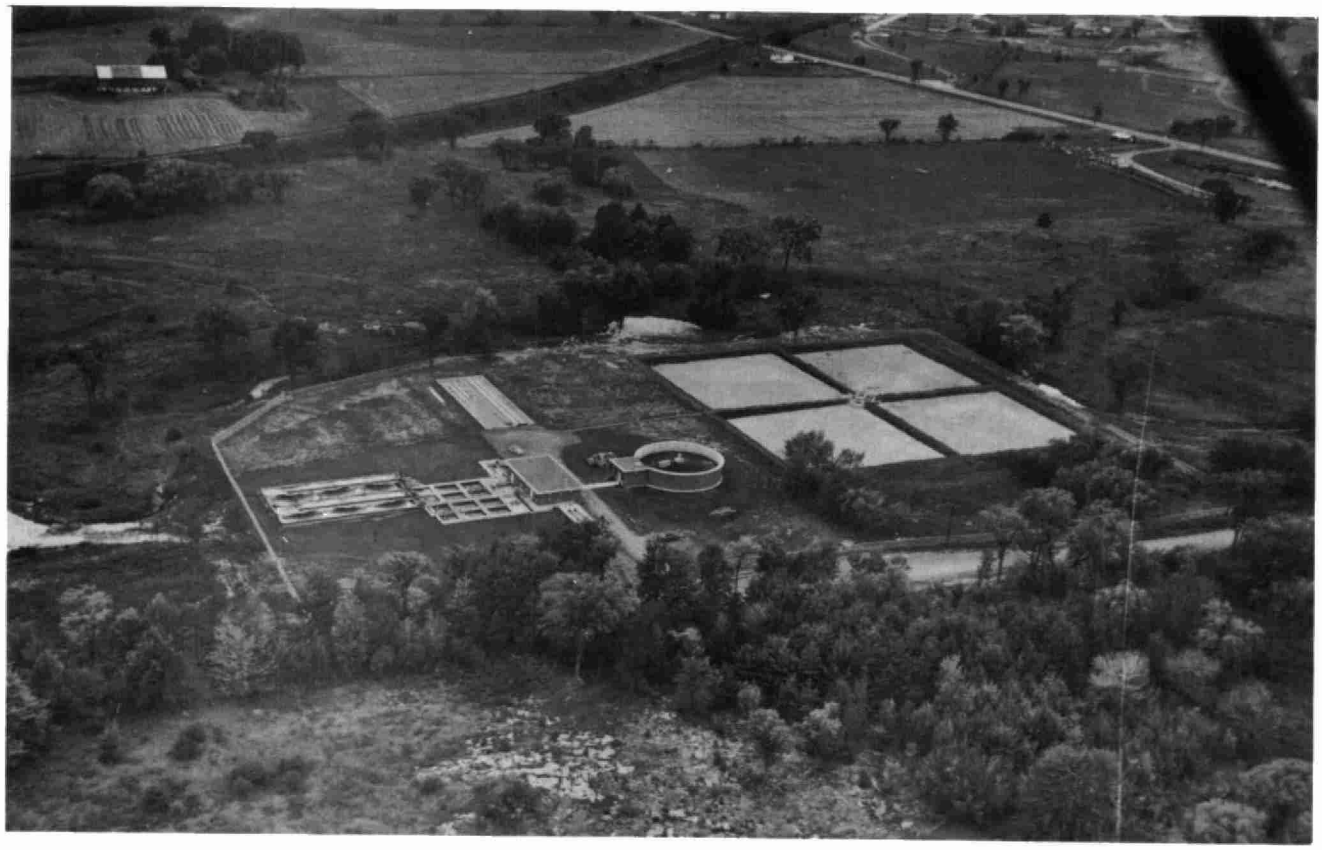
Project Staff

Operators: B. Arcand
G. Crouch

COMMENTS

As shown above, the total staff complement is three men. One casual labourer was hired for the summer months to alleviate the work load during those months.

Two new operators were hired at the plant in 1964. One operator was hired to fill the vacancy created by a resignation in December of 1963 and the other operator was hired to fill the vacancy created by a resignation in the beginning of 1964.



Description of Project

INFLUENT WORKS

The waste from the north east section of the Township of Nepean is directed by gravity sewers and trunk sewers to the Woodroffe Avenue pumping station. At the Woodroffe Avenue pumping station the waste is lifted into a 30 inch trunk sewer that follows the northern limit of the township picking up waste from Bell's Corners and other subdivisions along the way and conveying it to the Shirley's Bay pumping station.

The raw waste is pumped from the Shirley's Bay pumping station via a 16 inch force main to the influent works of the plant. In the influent works, the waste flows through a bar screen where any large objects are removed and then into either one of two grit channels. In the grit channels, the flow is regulated so that the grit and sand settle out but the organic material remains in suspension. The grit channels are occasionally drained and the settled material manually removed and discarded.

PRIMARY SETTLING TANKS

In the two rectangular primary settling tanks, the waste is retained for 1.62 hours at design flow and approximately 50 percent of the suspended matter settles to the bottom of the tanks. Each settling tank is equipped with a scraper mechanism which moves the settled sludge to a hopper located at the bottom of the tank. The sludge is pumped from the settling tank to the digestion tank. Floating material is skimmed off the top of the tank and also pumped to the digestion tank.

AERATION

Settled sewage from the primary settling tanks flows by gravity to the aeration tanks where it is mixed with biologically active sludge which is returned from the final settling tanks. In the aeration tanks, the waste is retained for 6.75 hours at design flow to enable the biologically active floc to oxidize and assimilate the polluting organic matter still remaining in the waste.

It is possible to add primary effluent to the aeration tanks at various points. This permits the use of modifications to the activated sludge process such as step aeration.

Air and agitation is supplied to the process by six mechanical aerators equipped with two 15 HP motors. The tank contents are turned over every 15 minutes.

FINAL SETTLING TANKS

The mixed liquor from the aeration section is retained in the final settling tanks for 1.62 hours at design flow and allows the activated sludge to settle in the tanks. The sludge is scraped to the one end of the tank by a scraper mechanism and collected on the bottom of the tanks from where it is pumped by two 800 IGPM pumps to a splitter box. The splitter box is employed to control the wasting of excess sludge to the primary settling tanks. The remaining liquid flows over the weirs of the final settling tanks and is chlorinated in the chlorine contact chamber for approximately 15 minutes and then flows to Watts Creek as the final effluent.

SLUDGE DIGESTION TANKS

The Township of Nepean utilizes single stage digestion. The sludge from the primary settling tanks is automatically pumped to the digester by a pre-set timer mechanism.
The digester is equipped with a floating steel cover. The contents of the digester are mixed by a Perth gas recirculating system which collects the gas produced by the decomposition of the sludge and forces it back into the contents under pressure. Heat is applied to the digester by a heat exchanger located in the control building. The digester contents are circulated through the heat exchanger by two 150 US GPM pumps.
The digested sludge can be pumped on to the sludge drying beds or to the sludge lagoons. Here it is dried and used for land fill.



FINAL CLARIFIERS

PROJECT COSTS

59-S-35

TOTAL CAPITAL COST: $1,351,191.62

The total cost to the municipality during 1964 was as follows:

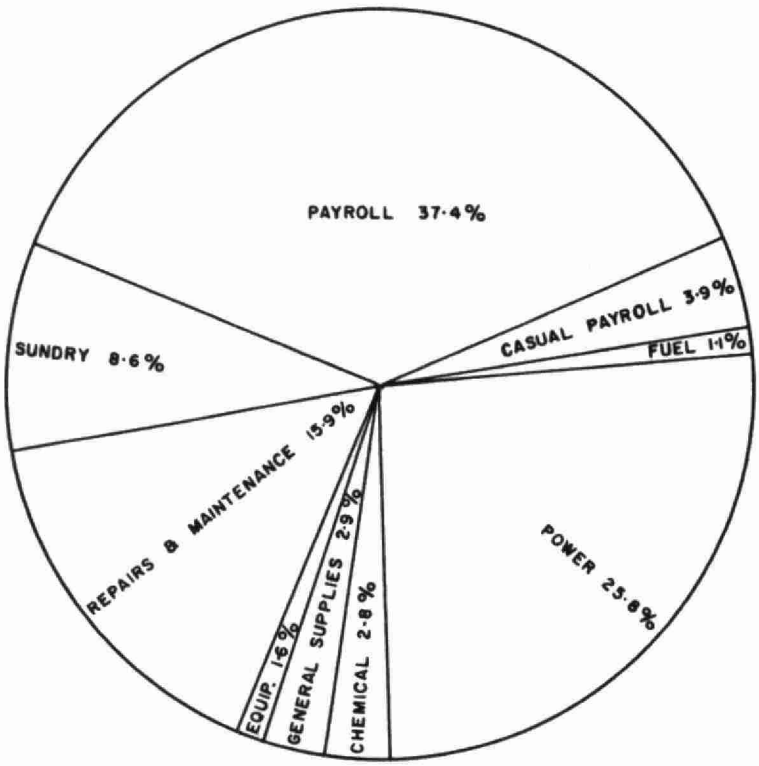
Net Operating	$	31,159.12
Debt Retirement		15,639.00
Reserve		10,435.00
Interest Charged		43,566.41
TOTAL	$	100,799.53

RESERVE ACCOUNT

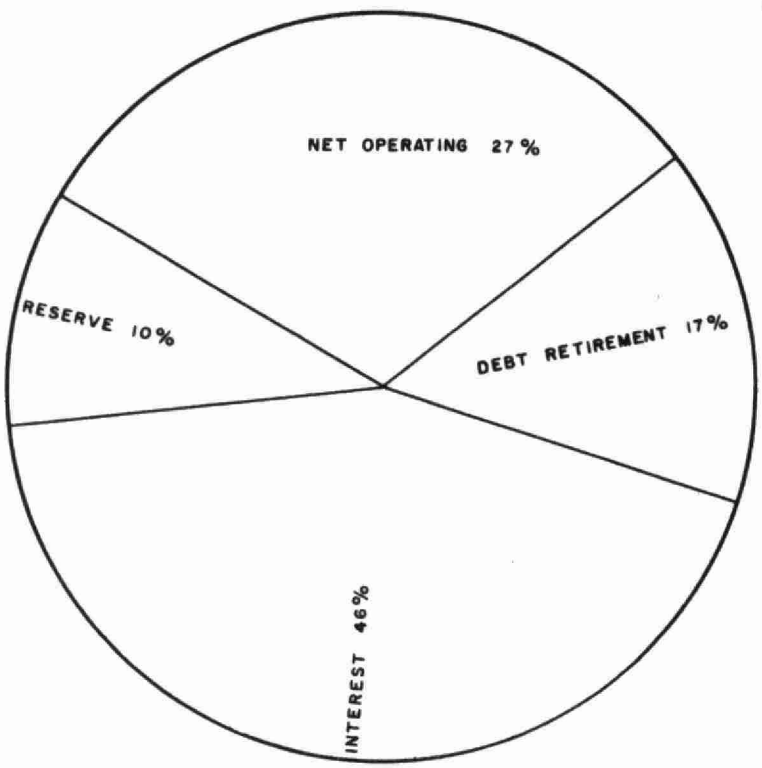
Balance at January 1, 1964	$	21,755.64
Deposited by Municipality		10,435.00
Interest Earned		1,385.64
	$	33,576.28
Less Expenditures		11,490.42
Balance at December 31, 1964	$	22,085.86

LONG TERM DEBT: The municipality's long term debt to the OWRC, revised December 31, 1964 was $775,561.

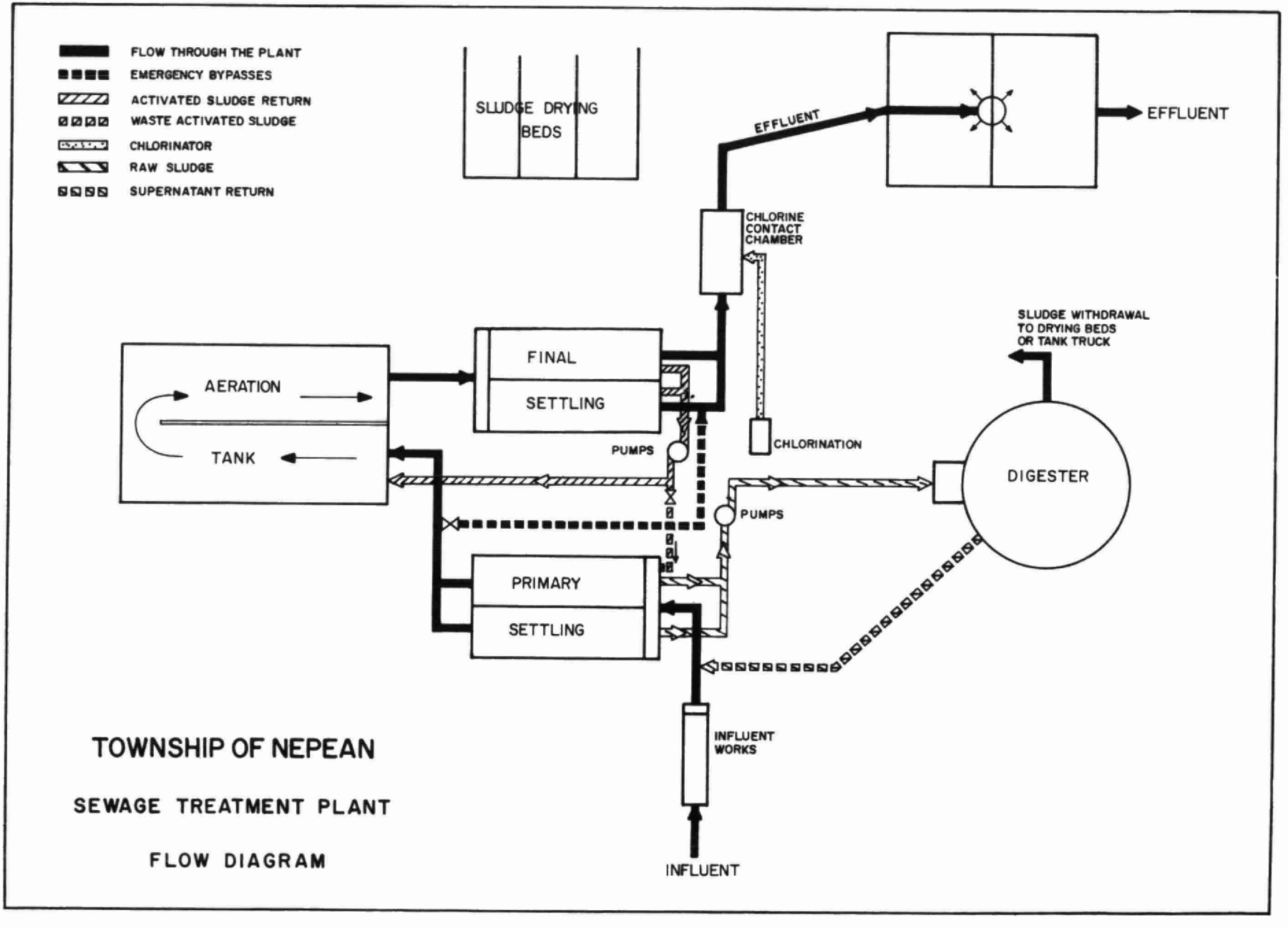
1964 OPERATING COSTS



TOTAL ANNUAL COST (BOTH PROJECTS)



Technical Section


FLOW THROUGH THE PLANT
EMERGENCY BYPASSES
ACTIVATED SLUDGE RETURN
WASTE ACTIVATED SLUDGE
CHLORINATOR
RAW SLUDGE
SUPERNATANT RETURN
SLUDGE DRYING BEDS
EFFLUENT
EFFLUENT
CHLORINE CONTACT CHAMBER
SLUDGE WITHDRAWAL TO DRYING BEDS OR TANK TRUCK
FINAL
SETTLING
AERATION
TANK
PUMPS
CHLORINATION
DIGESTER
PUMPS
PRIMARY
SETTLING
INFLUENT WORKS
INFLUENT
TOWNSHIP OF NEPEAN
SEWAGE TREATMENT PLANT
FLOW DIAGRAM

Design–Data

GENERAL

Type of Plant - Activated sludge.

Design Population - 15,000 persons.

Per Capita Flow - 100 gallons per capita per day.

Design Plant Flow - 1,500,000 gallons per day.

Five Day BOD -

Raw Sewage	-	140 PPM
Removal	-	95%

Suspended Solids -

Raw Sewage	-	295 PPM
Removal	-	90%

PRIMARY TREATMENT

Influent Sewer

Sixteen inch force main from Shirley's Bay pumping station.

Screening

Manually cleaned bar screen with two inch spaces.

Grit Removal

Two manually cleaned grit removal channels - 35'6" x 3'6" x 1'6".

Volume - 184 cubic feet or 1150 Imperial gallons.

Detention period - 1.11 minutes at design flow.

PRIMARY SETTLING TANKS

Units - Two 60' x 15' x 9'.

Total volume - 16,200 cubic feet or 101,000 Imperial gallons.

Detention time - 1.62 hours at design flow.

Surface Settling Rate - 835 Imperial gallons per square foot of tank per day

Weir Overflow Rate - 9450 Imperial gallons per lineal foot of weir per day.

Manually operated scum troughs.

SECONDARY TREATMENT

Aeration Section

Two rectangular aeration tanks - 90' x 30' x 12'6".

Total volume - 67,500 cubic feet, or 420,000 Imperial gallons.

Detention time - 6.75 hours at a design flow of 1.5 MGD.

Air Supply

Six mechanical type aerators.

Simplex high intensity aerating cones as manufactured by Ames Crosta Mills Co. Ltd.

Secondary Settling Tanks

Two rectangular concrete settling tanks with United Steel Corporation Limited collectors.

Units - Two 60' x 15' x 9'.

Total volume - 16,200 cubic feet or 101,000 Imperial gallons.

Detention time - 1.62 hours at design flow.

Surface Settling Rate - 835 Imperial gallons per square foot of tank per day.

Weir Overflow Rate - 9150 Imperial gallons per lineal foot of weir per day.

The return sludge is pumped to a splitter box from sludge wet well by two "Allispede" Smart-Turner Machine Co. Ltd. pumps of 800 IGPM capacity.

Digester

One concrete tank 60 feet in diameter by 21' SWD.

Total volume - 59,200 cubic feet or 370,000 Imperial gallons.

The tank covered by a Pacific Flush Tank Company floating steel cover and contents agitated by a 150 cubic feet per minute Pearth Gas Recirculation Unit.

Loading - 4.0 cubic feet per capita. 2.02 pounds solids per cubic foot of tank per month.

Disposal - Sludge drying beds and sludge lagooning.

Heat Exchanger

One Pacific Flush Tank Company No. 370 heat exchanger.

Chlorination

Dimension of Tank - 32' x 16' x 5' 6" - 2,820 cubic feet or 17,600 gallons.

Detention time - 17 minutes at design flow.

One Wallace and Tiernan chlorinator, Type A-731.

Sand Filters

Four sand filter beds 175' x 175' each.

Used during summer months.

PUMPING STATIONS

Woodroffe Avenue Pumping Station

Unit No. 1

10 HP electrically driven "Buffalo" pump - 300 USGPM @ 46 foot TDH. RPM - 1150.

Unit No. 2

20 HP electrically driven "Buffalo" pump - 850 USGPM @ 46 foot TDH. RPM - 1150.

Unit No. 3

25 HP electrically driven "Buffalo" pump - 1400 USGPM @ 46 foot TDH. RPM - 900

Standby Engine - Wisconsin air-cooled Type - VG-40.

Shirley's Bay Pumping Station

Unit No. 1

30/22 HP electrically driven "Buffalo" pump.

Capacity - 700-500 Imperial GPM @ 33.5 foot TDH.

RPM - 1150 - Capacity - 1675

Impeller Size - 12 1/2 inches.

Unit No. 2

30/22 HP electrically driven "Buffalo" pump.

Capacity - 700-750 Imperial GPM @ 35.0 foot TDH.

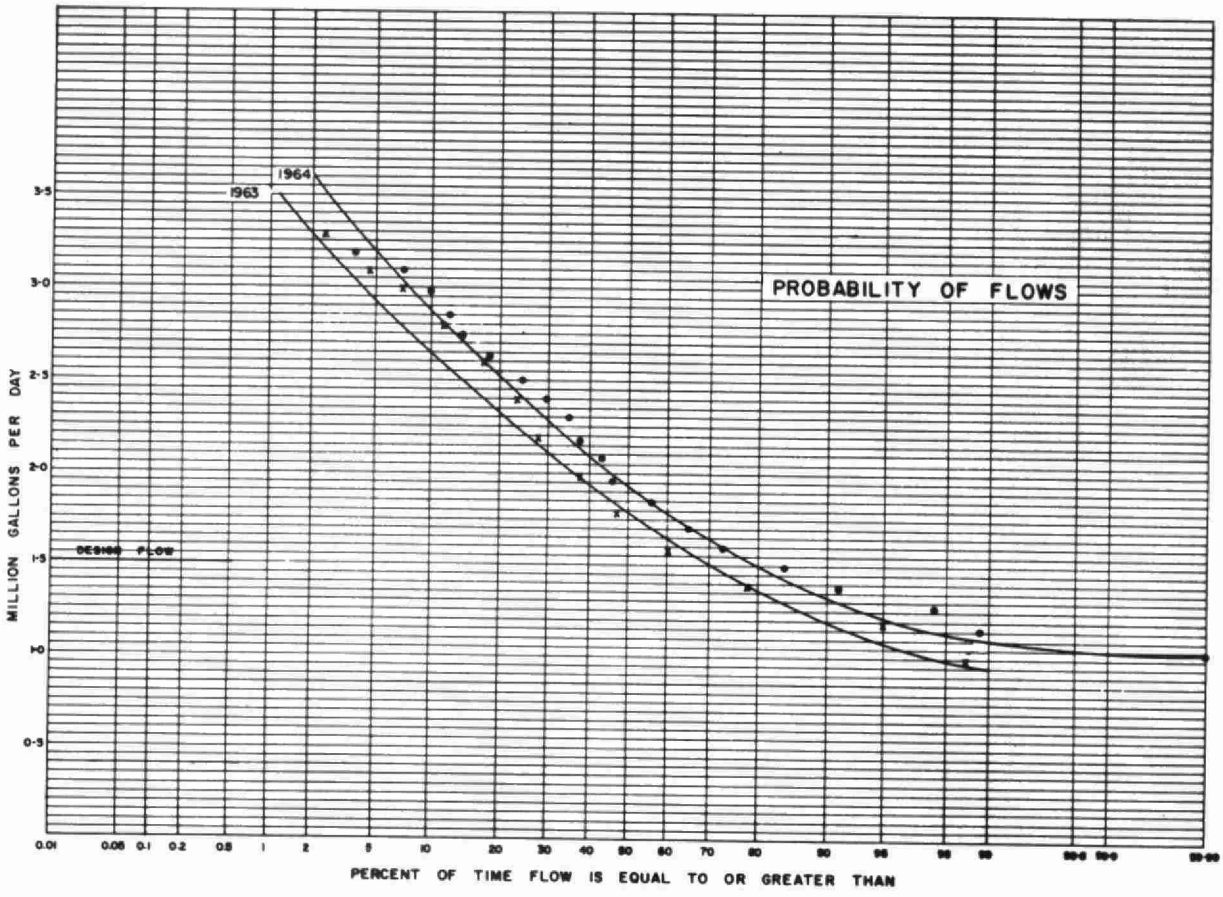
RPM - 1150 - Capacity 1850

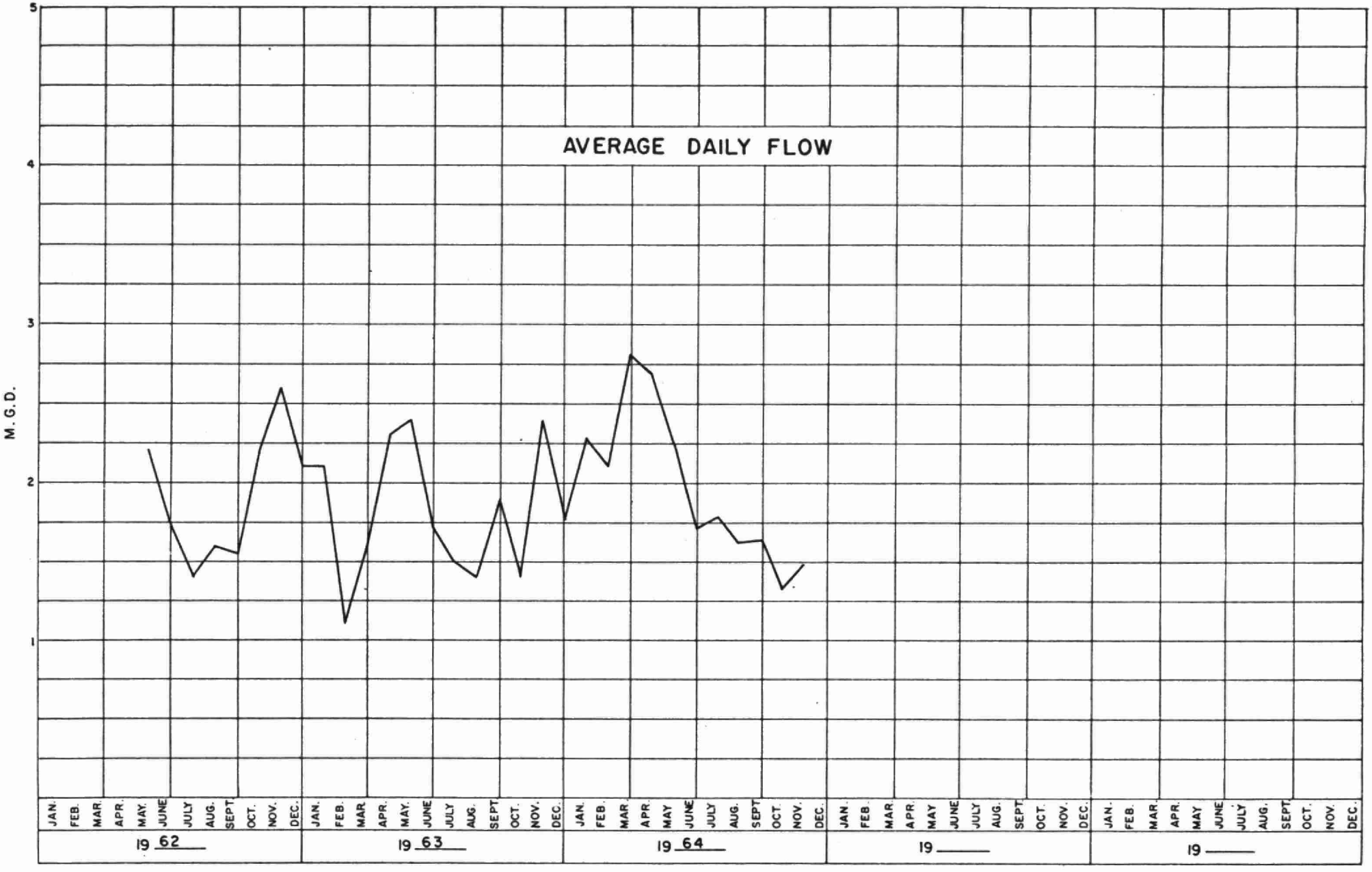
Impeller Size - 13.0 inches.

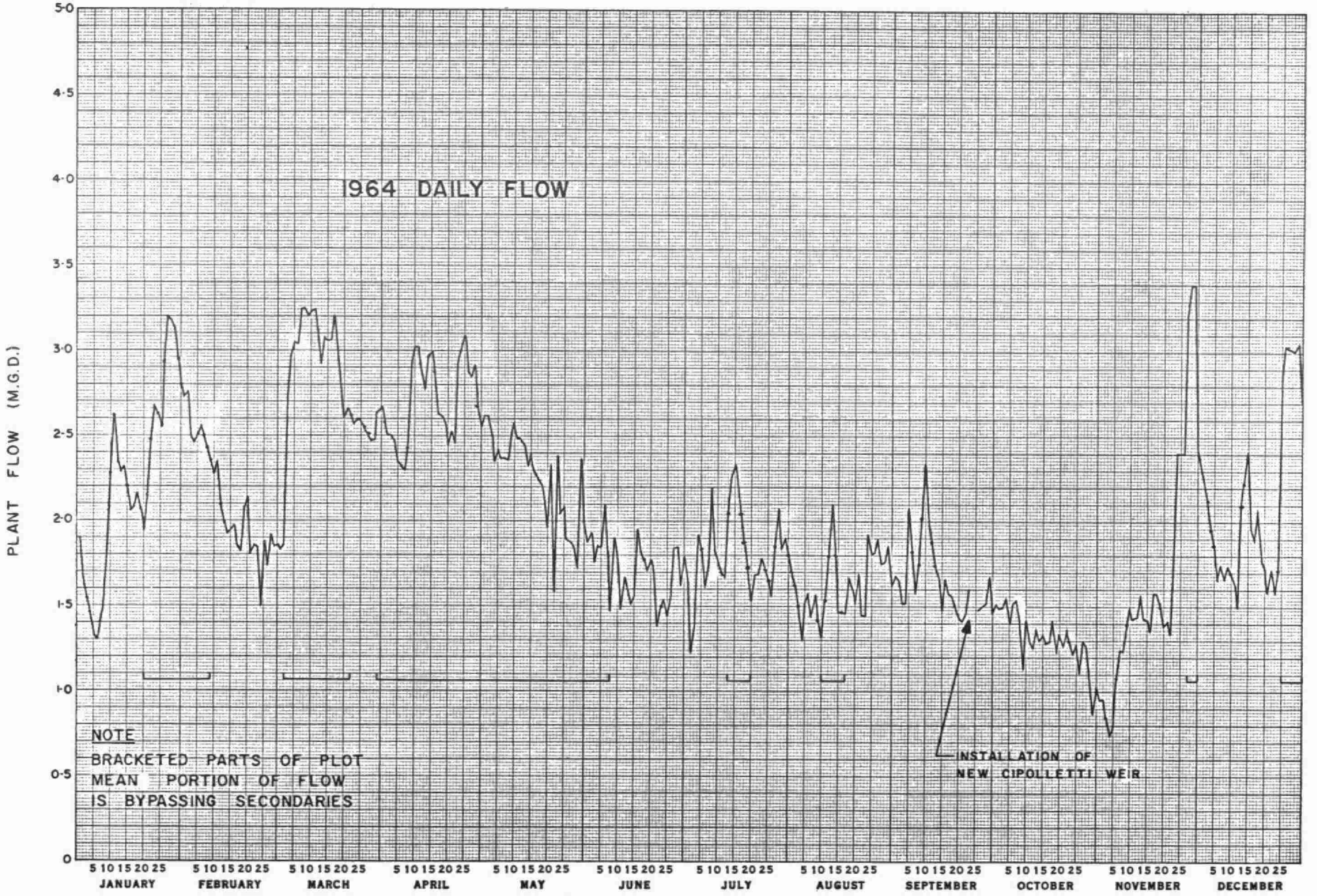
Process Data

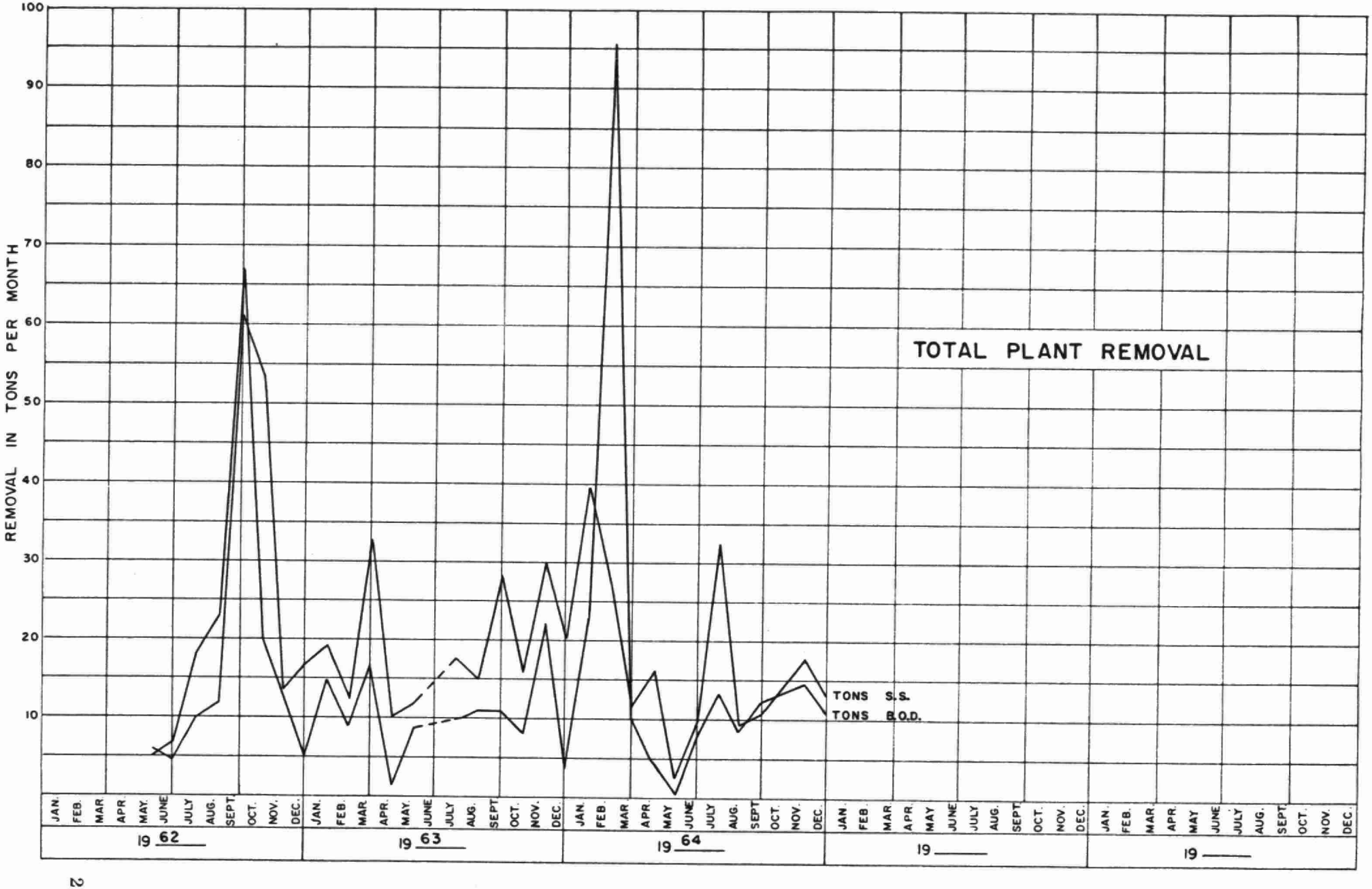
From the probability plot below, it will be noted that in 1963 the plant received approximately 1.8 mgd fifty percent of the time. In 1964 the plant received approximately 1.95 mgd fifty percent of the time. Only 20 percent of the time, the flow to the plant was equal to or less than the design flow of 1.5 mgd.

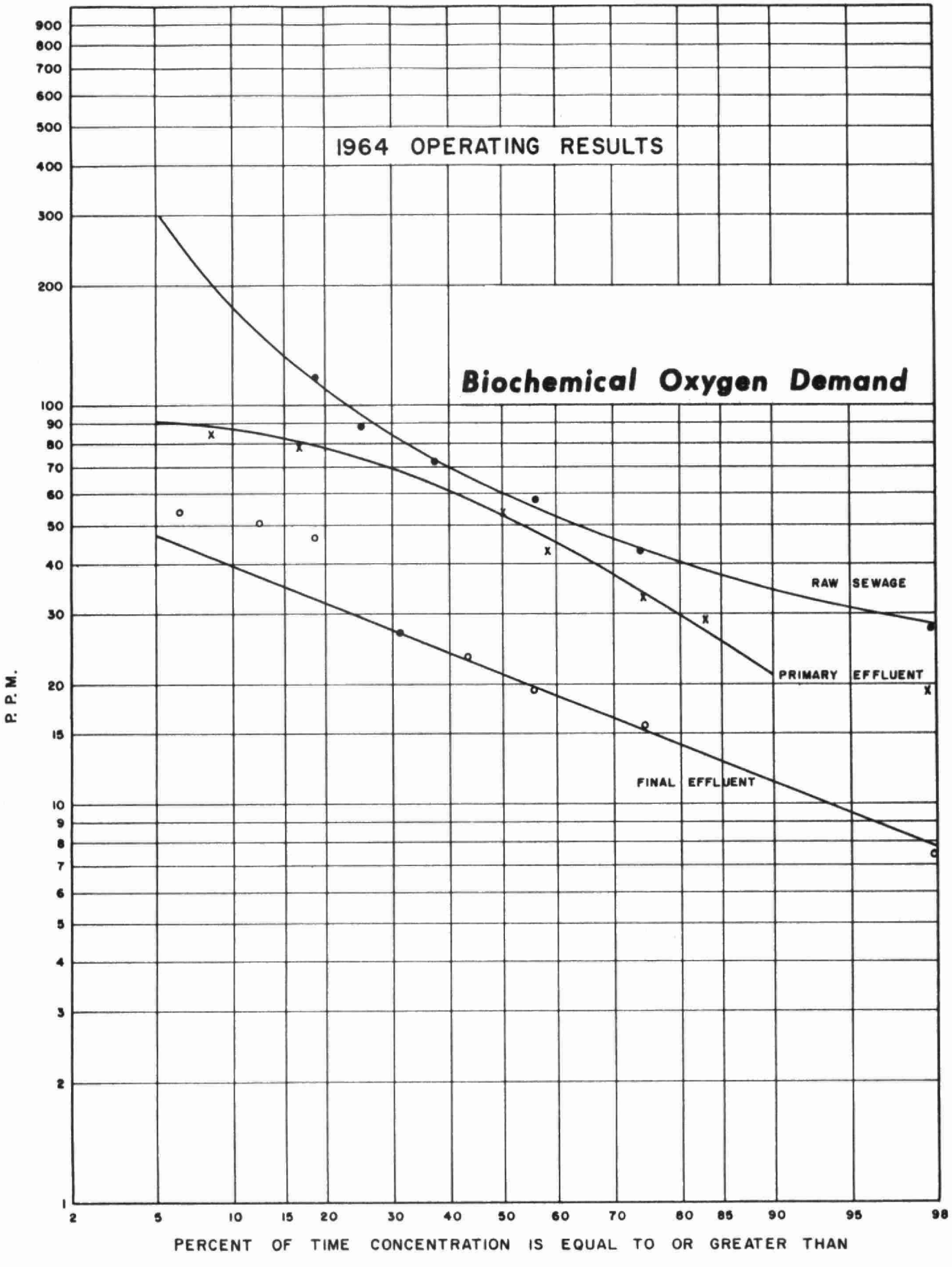
When flows to the Shirley's Bay Pumping Station exceeded 3.5 mgd by-passing of the raw sewage to Watts Creek begins.

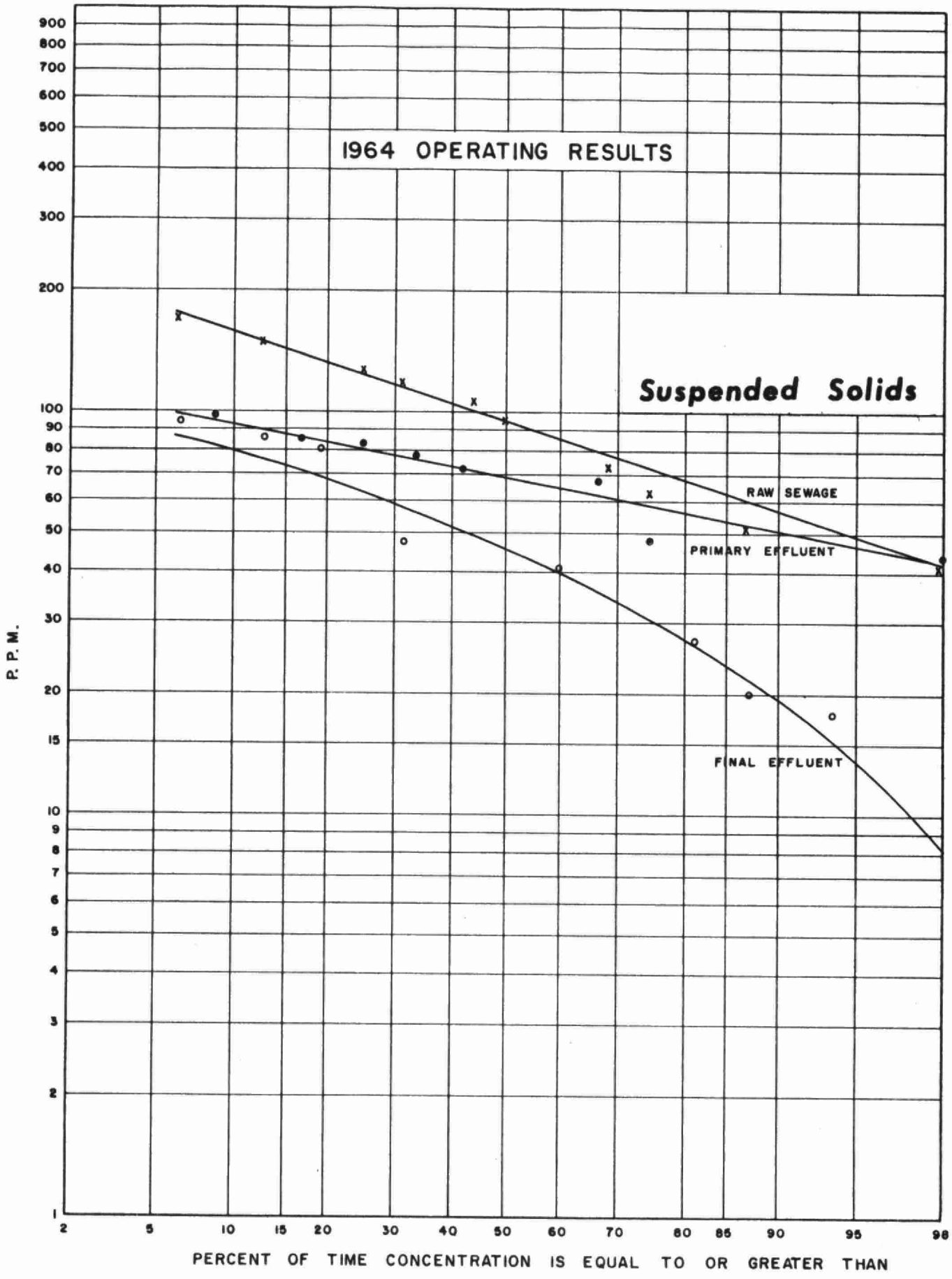


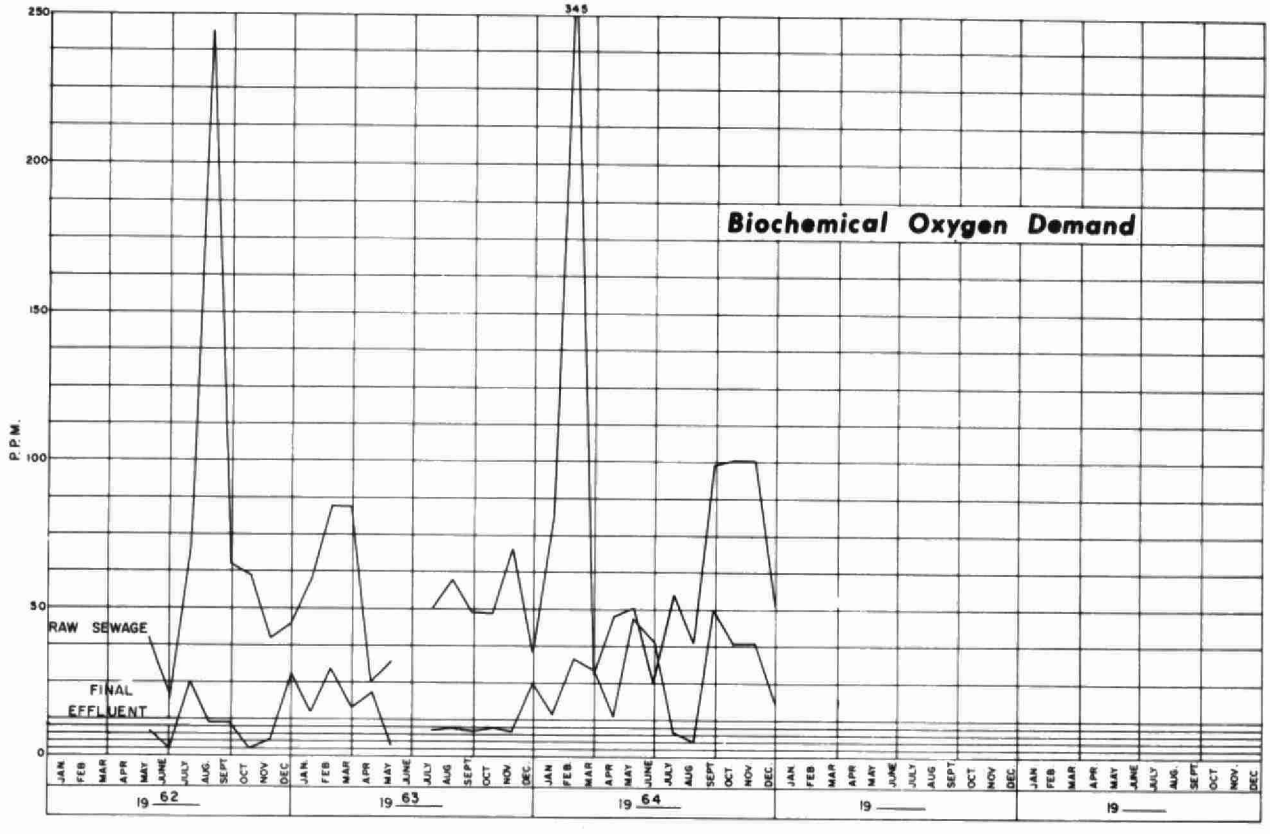

AVERAGE DAILY FLOW
M.G.D.
5
4
3
2
1
JAN. FEB. MAR. APR. MAY. JUNE JULY AUG. SEPT. OCT. NOV. DEC.
19 62
19 63
19 64
19
19


1964 DAILY FLOW
PLANT FLOW (M.G.D.)
5·0
4·5
4·0
3·5
3·0
2·5
2·0
1·5
1·0
0·5
0
5 10 15 20 25
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
NOTE
BRACKETED PARTS OF PLOT
MEAN PORTION OF FLOW
IS BYPASSING SECONDARIES
INSTALLATION OF
NEW CIPOLLETTI WEIR

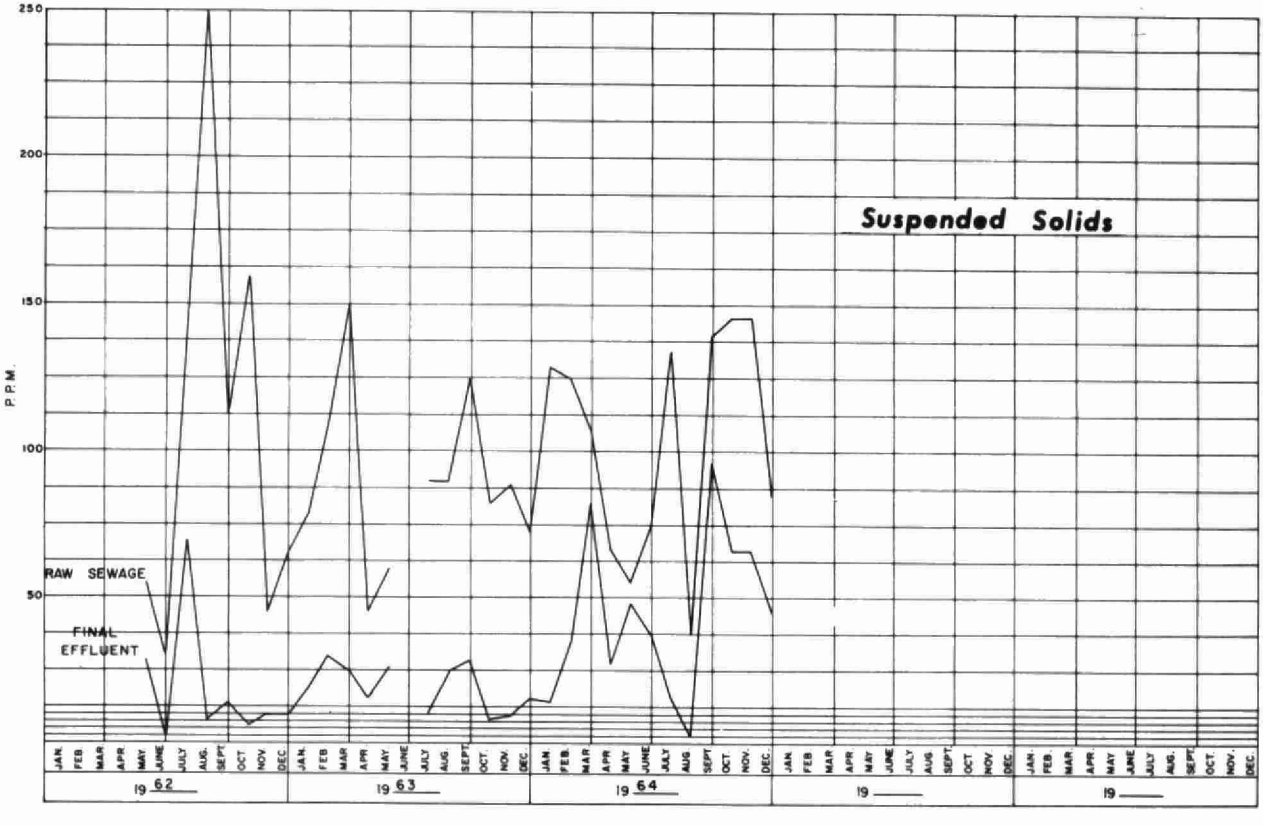

REMOVAL IN TONS PER MONTH
100
90
80
70
60
50
40
30
20
10
TOTAL PLANT REMOVAL
TONS S.S.
TONS B.O.D.
JAN. FEB. MAR APR. MAY JUNE JULY AUG. SEPT OCT. NOV. DEC.
19 62
19 63
19 64
19 ____
19 ____


1964 OPERATING RESULTS
Biochemical Oxygen Demand
RAW SEWAGE
PRIMARY EFFLUENT
FINAL EFFLUENT
P. P. M.
900
800
700
600
500
400
300
200
100
90
80
70
60
50
40
30
20
15
10
9
8
7
6
5
4
3
2
1
2
5
10
15
20
30
40
50
60
70
80
85
90
95
98
PERCENT OF TIME CONCENTRATION IS EQUAL TO OR GREATER THAN


1964 OPERATING RESULTS
Suspended Solids
RAW SEWAGE
PRIMARY EFFLUENT
FINAL EFFLUENT
P. P. M.
900
800
700
600
500
400
300
200
100
90
80
70
60
50
40
30
20
15
10
9
8
7
6
5
4
3
2
1
2
5
10
15
20
30
40
50
60
70
80
85
90
95
98
PERCENT OF TIME CONCENTRATION IS EQUAL TO OR GREATER THAN



MONTHLY VARIATIONS



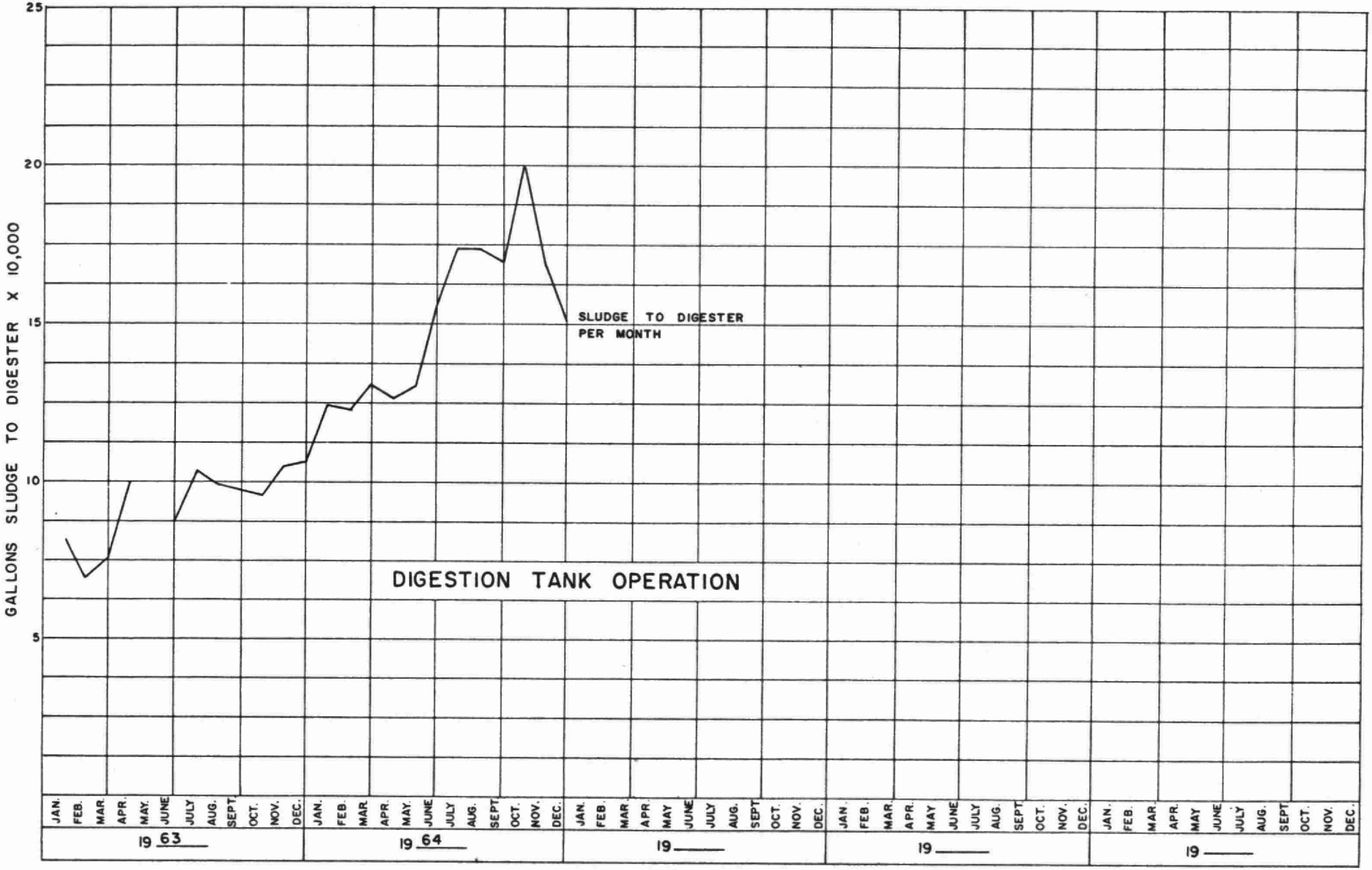
GRIT, B.O.D AND S.S. REMOVAL

MONTH	B. O. D.				S. S.				GRIT REMOVAL CU. FT.
	INFLUENT P.P.M.	EFFLUENT P.P.M.	% REDUCTION	TONS REMOVED	INFLUENT P.P.M.	EFFLUENT P.P.M.	% REDUCTION	TONS REMOVED	
JAN.	80	14	82.5	22.8	129	14	89	39.7	-
FEB.	346	33	90.4	95.9	125	34	73	27.9	-
MAR.	52	28	46	10.4	108	82	24	11.3	
APR.	25	14	44	4.5	67	27	59.5	16.2	
MAY	28	27	3.5	0.3	55	48	12.5	2.4	-
JUNE	47	16	66	8	76	38	50	9.8	-
JULY	56	7.6	86.5	13.4	134	17	87.5	32.5	-
AUG.	39	5.4	86.0	8.4	38	2	94.5	9.1	-
SEPT.	100	51	49.0	12.2	140	96	31.5	11.0	-
OCT.	84 *	23	72.5	12.4	100 *	43	57.0	11.6	-
NOV.	102	38	62.5	14.7	147	66	55.0	18.0	-
DEC.	52	19	63.5	10.8	86	46	46.5	13.2	-
TOTAL	-	-	-	221.6	-	-	-	207.00	-
AVG.	84	23	72.5	18.5	100	43	57.0	17.2	-

COMMENTS

The waste received at the plant in 1964 had an average BOD of 84 ppm. The average BOD removed at the plant was 72.5 percent resulting in an effluent of 23 ppm BOD. The concentration of the BOD in the effluent is above the OWRC objective of 15 ppm BOD. A total of 221.6 tons of BOD were removed by the plant in 1964.

The waste contained an average of 100 ppm of suspended solids. The average removal of suspended solids was 57 percent. A total of 207.0 tons of suspended solids were removed by the plant in 1964.

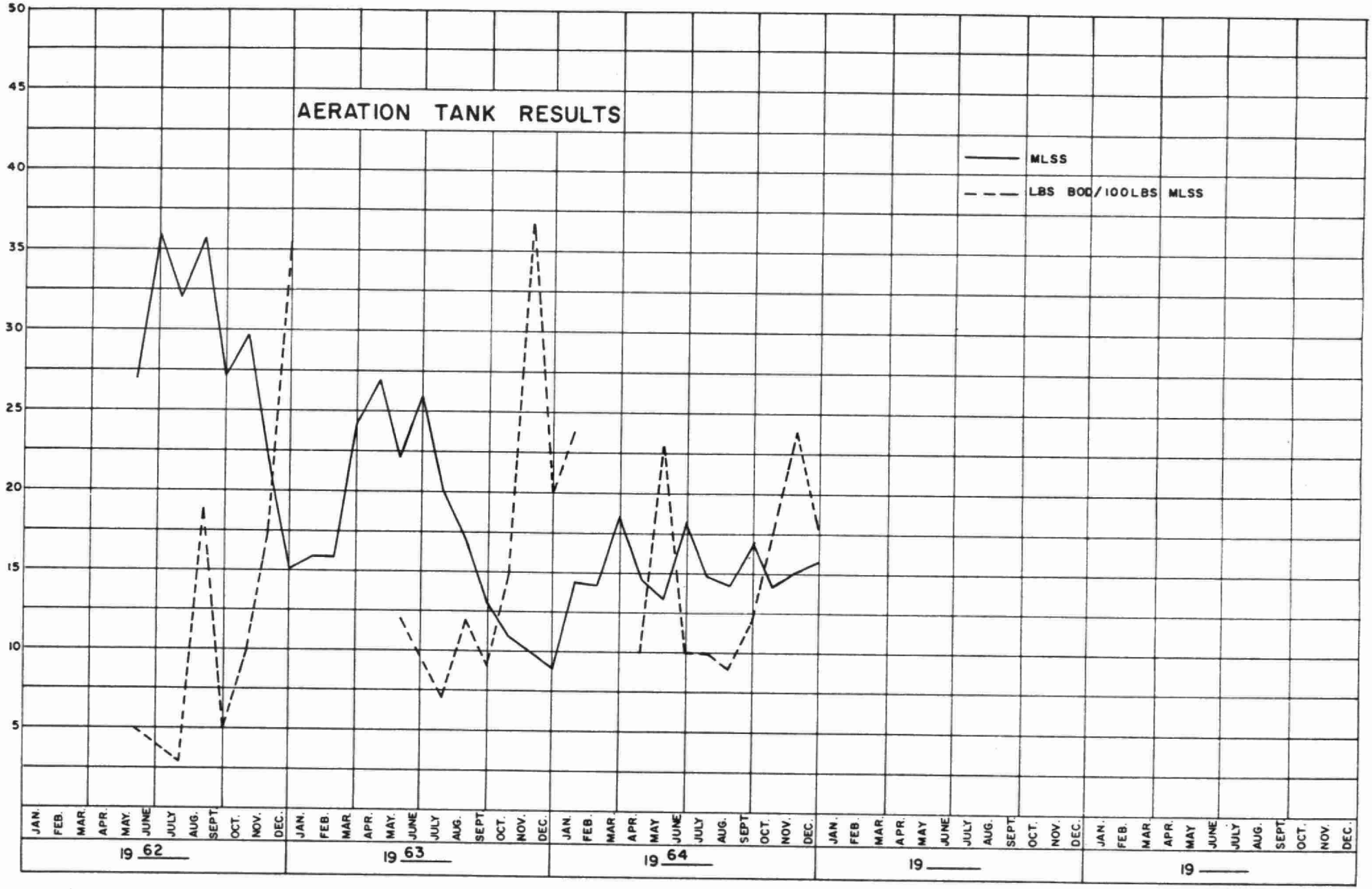

GALLONS SLUDGE TO DIGESTER X 10,000
25
20
15
10
5
SLUDGE TO DIGESTER PER MONTH
DIGESTION TANK OPERATION
JAN. FEB. MAR. APR. MAY. JUNE JULY AUG. SEPT OCT. NOV. DEC.
19 63
19 64
19 ____
19 ____
19 ____

DIGESTER OPERATION

MONTH	SLUDGE TO DIGESTERS			SLUDGE FROM DIGESTERS			GAS PRODUCED 1000'S Cu. Ft.
	1000'S CU.FT.	% SOLIDS	% VOL. MAT.	1000'S CU.FT.	% SOLIDS	% VOL. MAT	
JAN.	19.62	-	-	-	-	-	-
FEB.	19.52	-	-	-	-	-	-
MAR.	20.86	-	-	-	-	-	-
APR.	20.19	-	-	-	-	-	-
MAY	20.84	-	-	12.74	-	-	-
JUNE	25.16	-	-	21.88	-	-	-
JULY	27.82	-	-	11.06	-	-	-
AUG.	27.82	-	-	10.58	-	-	-
SEPT.	26.92	-	-	19.95	-	-	-
OCT.	32.31	-	-	11.38	-	-	-
NOV.	26.92	-	-	16.83	-	-	-
DEC.	24.10	-	-	-	-	-	-
TOTAL	292.08	-	-	104.42	-	-	-
AVG.	24.34	-	-	8.70	-	-	-

COMMENTS

In 1964, 292,080 cubic feet of sludge were removed from the primary sedimentation tanks and pumped to the digester for bacterial decomposition. The sludge in the digester was reduced to 104,420 cubic feet and pumped to the sludge lagoon to facilitate further separation of the liquid from the solids.


AERATION TANK RESULTS
MLSS
LBS BOD/100LBS MLSS
50
45
40
35
30
25
20
15
10
5
JAN. FEB. MAR. APR. MAY. JUNE JULY AUG. SEPT OCT. NOV. DEC.
19 62
19 63
19 64
19 ____
19 ____

AERATION SECTION

MONTH	PRIM. EFFL. B.O.D. P.P.M.	M.L.S.S. P.P.M.	LBS. BOD. PER 100 LBS. M. L. S. S.	CUBIC FEET AIR PER LB. B.O.D. REMOVED
JANUARY	55	1443	24	-
FEBRUARY	-	1437	-	-
MARCH	-	1823	-	-
APRIL	20	1472	10	-
MAY	52	1337	23	-
JUNE	45	1802	10	-
JULY	35	1490	10	-
AUGUST	32	1431	9	-
SEPTEMBER	52	1678	12	-
OCTOBER	-	1426	-	-
NOVEMBER	81	1512	24	-
DECEMBER	54	1576	18	-
TOTAL	-	-	-	-
AVERAGE	47	1536	16	-

COMMENTS

It will be noted that the BOD loading to the aeration tanks was rather low. This can be attributed to the weak primary effluent which is a result of the rather large infiltration of ground water into the sanitary sewer system.

CHLORINATION

MONTH	PLANT FLOW (MG)	POUNDS CHLORINE	DOSAGE RATE (P.P.M)
JANUARY	68.989	-	-
FEBRUARY	61.279	-	-
MARCH	86.917	-	-
APRIL	81.079	-	-
MAY	69.897	1049 (21)	2.22
JUNE	51.353	1363	2.65
JULY	55.585	1326	2.38
AUGUST	50.317	1404	2.79
SEPTEMBER	49.920	1505	3.01
OCTOBER	40.695	* 738 (15)	3.50
NOVEMBER	44.369	-	-
DECEMBER	65.811	-	-
TOTAL	726.411	7385	-
AVERAGE	60.534	1231	2.69

* 15 days chlorination

COMMENTS

Chlorine at this plant is normally used for disinfection of the final effluent during the months of May 15 to October 15 inclusive. Approximately 2.69 ppm of chlorine is necessary to give the final effluent a chlorine residual of 0.5 ppm after a retention of 15 minutes.

LABORATORY LIBRARY
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RECOMMENDATIONS

Enlargement of the present plant should be considered, and the Woodroffe Avenue Pumping Station should be modernized and enlarged.


ONTARIO WATER RESOURCES COMMISSION